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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/036,469	01/07/2002	Ram S. Narang	D/96176D1D	6090

7590 07/03/2003

Patent Documentation Center  
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EXAMINER

HAMILTON, CYNTHIA

ART UNIT

PAPER NUMBER

1752

DATE MAILED: 07/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/036,469

Applicant(s)

NARANG ET AL.

Examiner

Cynthia Hamilton

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 4/17/03, 1/7/02, 12/18/02.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 10-13, 15-27, 30, 31, 33, 44, 45 and 47-71 is/are pending in the application.
- 4a) Of the above claim(s) 10-13, 17-27, 30-31, 38-41, and 47-56 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 16, 33, 44, 45, 57-60 and 64-71 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 10-13, 15-27, 30, 31, 33, 44, 45 and 47-71 are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

#### DETAILED ACTION

1. If applicant desires priority under 35 U.S.C. 121 based upon a previously filed application, specific reference to the earlier filed applications must be made in the instant application. For benefit claims under 35 U.S.C. 120, 121 or 365(c), the reference must include the relationship (i.e., continuation, divisional, or continuation-in-part) of the applications. This should appear as the first sentence of the specification following the title, preferably as a separate paragraph unless it appears in an application data sheet. The status of nonprovisional parent application(s) (whether patented or abandoned) should also be included. If a parent application has become a patent, the expression "now Patent No. \_\_\_\_" should follow the filing date of the parent application. If a parent application has become abandoned, the expression "now abandoned" should follow the filing date of the parent application. **Applicants have made a priority claim to 09/246,167 and 08/705,372 but have not amended their disclosure to perfect such a claim as required.**

If the application is a utility or plant application filed under 35 U.S.C. 111(a) on or after November 29, 2000, the specific reference must be submitted during the pendency of the application and within the later of four months from the actual filing date of the application or sixteen months from the filing date of the prior application. If the application is a utility or plant application which entered the national stage from an international application filed on or after November 29, 2000, after compliance with 35 U.S.C. 371, the specific reference must be submitted during the pendency of the application and within the later of four months from the date on which the national stage commenced under 35 U.S.C. 371(b) or (f) or sixteen months from the filing date of the prior application. See 37 CFR 1.78(a)(2)(ii) and (a)(5)(ii). This time

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period is not extendable and a failure to submit the reference required by 35 U.S.C. 119(e) and/or 120, where applicable, within this time period is considered a waiver of any benefit of such prior application(s) under 35 U.S.C. 119(e), 120, 121 and 365(c). A priority claim filed after the required time period may be accepted if it is accompanied by a grantable petition to accept an unintentionally delayed claim for priority under 35 U.S.C. 119(e), 120, 121 and 365(c). The petition must be accompanied by (1) the reference required by 35 U.S.C. 120 or 119(e) and 37 CFR 1.78(a)(2) or (a)(5) to the prior application (unless previously submitted), (2) a surcharge under 37 CFR 1.17(t), and (3) a statement that the entire delay between the date the claim was due under 37 CFR 1.78(a)(2) or (a)(5) and the date the claim was filed was unintentional. The Director may require additional information where there is a question whether the delay was unintentional. The petition should be addressed to: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

2. Claims 1-9, 14-15, 28-29, 32, 34-37, 42-43 and 46 have been cancelled by applicants. Claim 16 has been returned to its original wording by amendment. Claims 57-71 have been amended to reflect this return. Claims 57-71 are not part of the original disclosure. Claims 10-13, 15-27, 30-31, 33, 44-45, 47-56, and 57-71 are present.

3. Claims 10-13, 18-27, 30-31, 38-41, and 47-56 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 5. This leaves claims 16-17, 33, 44-45 and 57-60, 64-71.

4. Applicant's election with traverse of Group IV in Paper No. 5, filed January 13, 2003 is acknowledged. The traversal is on the ground(s) that (1) Groups II, III, IV, V and VI can be

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examined together with Group I claims without undue burden "since all recite similar polymeric compositions" and (2) that separate classification in the patent classification system is not indicative of distinctness for the purposes of a restriction requirement, and (3) Group V and VI should be recombined because (a) they are drawn to the same polymer in that the printhead of Group V contains the polymer, i.e. the now claimed composition of claim 16 which is the generic claim of Group VI, and (b) Group V is only one claim. This is not found persuasive because in response to (1) the different classifications *are* an indication of undue burden with respect to separating Group VI searchable in Class 528 subclass 125 from Groups I-V none of which require a search of Class 528 at all. With respect to (3), the printhead of Group V does not require a search in any of the polymer classes because the issue of a print head of such complex design would never lead to such a search for just one component of one layer. If these groups had come in separate applications, they would have been assigned to separate Art Units. A search for the polymer composition of Group VI does not require the search for the printhead. The examination issues with respect to Group V and Group VI are completely different. The examiner does note that she did not give reason for the distinctness of Group IV from Groups I, II or III however, the separation of VI from IV and V is given. The only issue of importance in this application after election of Group VI is if any of the other groups should be recombined with Group VI. The applicant with respect to their (2) argument are right in that classification difference is not a showing of distinctness. It is a showing of undue burden on the examiner. Applicants failed to show where such distinctness was not established. The examiner was left to reconsider this in view of her action and applicant's broad allegation. The crosslinked or chain extended polymer composition of Group VI is either crosslinked or chain extended through

epoxy groups with an amine curing agent or is a composition comprised of (i) an amine curing agent and (ii) a crosslinked or chain extended polymer which was crosslinked or chain extended between epoxy groups on its monomer repeat units. The claim language leaves unclear which is actually claimed.

a. Inventions I and VI are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the process as claimed can be used to make uncrosslinked materials which do not have epoxy groups and never had epoxy groups.

b. Inventions VI and I are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case the product as claimed can be used in a materially different process than forming an allyl ether such as being heat cured to form an insulation layer in a printed circuit board wherein no allyl ether groups are ever present.

c. Inventions II and VI are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP §

806.05(f)). In the instant case the product as claimed can be made by another and materially different process such as that of Group III.

d. Inventions VI and II are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case the process for using the product as claimed can be practiced with another materially different product such as one that is not already crosslinked or chain extended.

e. Inventions III and VI are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process such as that of Group II.

f. Inventions VI and III are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case the process for using the product as claimed can be practiced with another materially different product such as one that is not already crosslinked or chain extended.

g. Inventions IV and VI are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be used to make a thermally cured material wherein no photosensitive steps of curing occur as well as no imaging steps at all. Such a process would be as a thermal bonding layer between circuit boards to form a stack to be heated and bonded together through layers of Group VI composition.

h. Inventions VI and IV are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case the process for using the product as claimed can be practiced with another materially different product such as that of Group I or a non crosslinked non chain extended polymer composition.

With respect to the number of claims in a group, this is not relevant to the issue of distinctness and is no indication in and of itself as to burden. The examiner has already addressed undue burden and distinctness issues.

As to Group V and Group VI having the same polymer composition present, the examiner has reconsidered this grouping. Claim 16 link(s) inventions V and VI. The restriction requirement between the linked inventions is subject to the nonallowance of the linking claim(s),



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claim 16. Upon the allowance of the linking claim(s), the restriction requirement as to the linked inventions shall be withdrawn and any claim(s) depending from or otherwise including all the limitations of the allowable linking claim(s) will be entitled to examination in the instant application. Applicant(s) are advised that if any such claim(s) depending from or including all the limitations of the allowable linking claim(s) is/are presented in a continuation or divisional application, the claims of the continuation or divisional application may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Where a restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. *In re Ziegler*, 44 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

The requirement is still deemed proper, but is not made final because of the addition of reasons for distinctness given above.

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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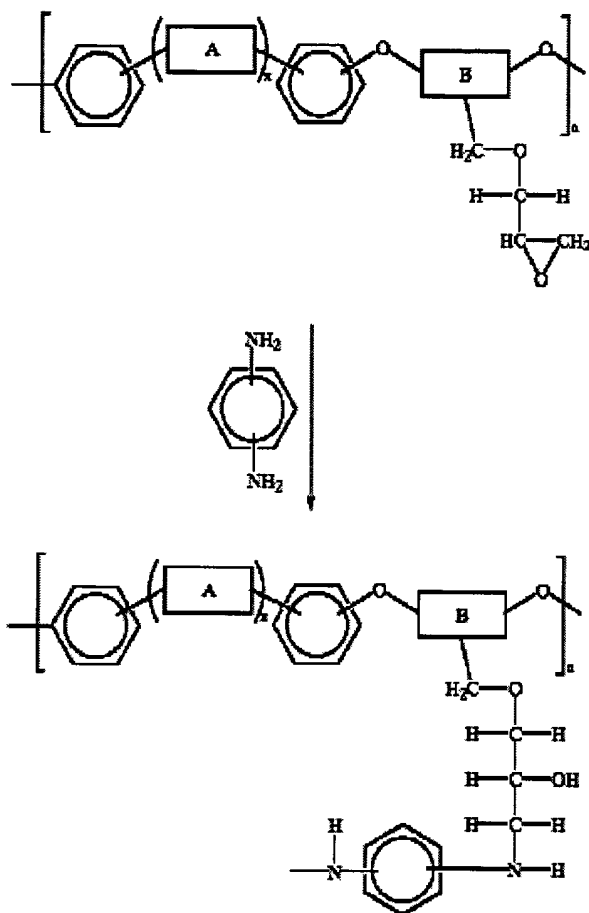
4. Claims 16, 33, 44-45 and 57-71 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 16, the wording in question is "A composition which comprised a crosslinked or chain extended polymer ... or mixtures thereof, ... said crosslinking or chain extension occurring through linking groups formed by a reaction between epoxy groups contained on at least some of the monomer repeat units of the precursor polymer and an amine curing agent." What is confusing is to what "and an amine curing agent" refers. Is it a second component of said composition or is it a reactant with epoxy groups to form the crosslinked or extended portion of the polymer of said composition? Does "between" refer to between one epoxy group with another or does it refer to between two epoxy groups? Is the "amine curing agent" part of the process of making the polymer or is it part of the mixture that makes up the composition? The wording is unclear. The original support for claim 16 beyond the bald words of claims 16-17 and 33 and 44-45 is most directly found on pages 100-101 as set forth below:

From Page 100-101

" Amine curing of the epoxidized polymer is also possible, with curing occurring upon the application of heat. While not being limited to any particular theory, it is believed that the curing scheme in one example is as

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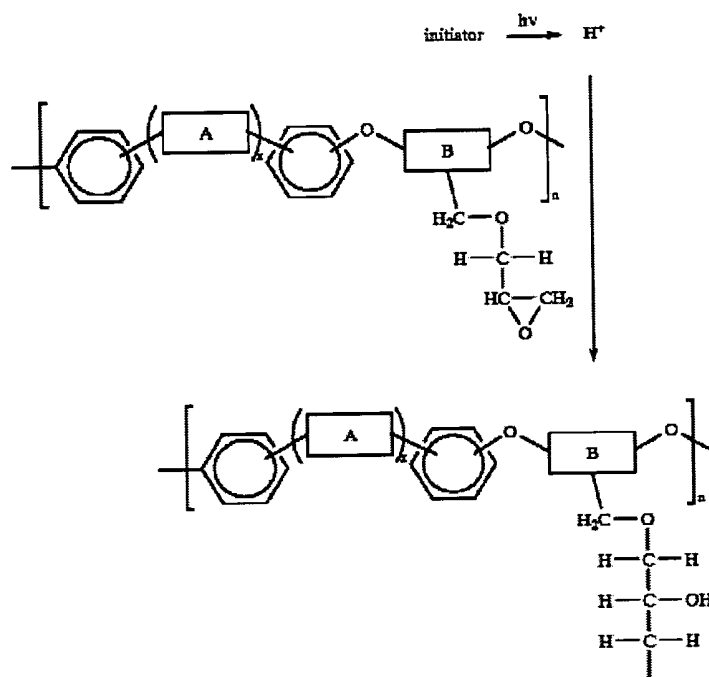
follows:



That crosslinking and extension through epoxy ring opening reactions is not limited to that with amines is evidenced by crosslinking and extending the polymers with epoxy groups via other means is set forth on pages 98-99 as follows:

" The photoresist containing the epoxidized polymer is developed by imagewise exposure of the material to radiation at a wavelength to which it is sensitive. While not being limited to any particular theory, it is believed that exposure to, for example, ultraviolet radiation generally causes generation of acidic species by the initiator, followed by reaction of the acidic species with the epoxy groups to cause ring opening and crosslinking or chain extension at the "long" bond sites as shown below:

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Thus, the issue as to whether the composition of claim 16 is the reactant mixed with the amine or the final product which the amine is used to obtain is not clarified by the specification. That both may occur is made clear on page 77, first paragraph

" While not required, it may be advantageous with respect to the ultimate properties of the photopatterned polymer if the polymer is functionalized with a second thermally polymerizable group, typically (although not necessarily) one which reacts at a temperature in excess of the glass transition temperature of the crosslinked or chain extended photopatternable polymer. The second polymerizable group can be either appended to the polymer chain or present as a terminal end group."

The only support found by this examiner for the use of amine curing agent in the application is through the application of heat and with epoxy groups. Thus epoxy groups must be present to use the amine curing agent of the specification. Thus, either the composition of claim 16 is

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drawn to a polymer to be thermally crosslinked or extended a second time or one that has a first time been so crosslinked or extended. On pages 84-86 is found:

In some instances a functional group can behave as either a photosensitivity-imparting group or a thermal sensitivity imparting group. For the polymers of the present invention having optional thermal sensitivity imparting groups thereon, at least two different groups are present on the polymer, one of which functions as a photosensitivity-imparting group and one of which functions as a thermal sensitivity imparting group. Either the two groups are selected so that the thermal sensitivity imparting group does not react or crosslink when exposed to actinic radiation at a level to which the photosensitivity-imparting group is sensitive, or photocuring is halted while at least some thermal sensitivity imparting groups remain intact and unreacted or uncrosslinked on the polymer. Typically (although not necessarily) the thermal sensitivity imparting group is one which reacts at a temperature in excess of the glass transition temperature of the polymer subsequent to crosslinking or chain extension via photoexposure.

When thermal sensitivity imparting groups are present, the polymers of the present invention are cured in a two-stage process which entails (a) exposing the polymer to actinic radiation, thereby causing the polymer to become crosslinked or chain extended through the photosensitivity-imparting groups; and (b) subsequent to step (a), heating the polymer to a temperature of at least 140.degree. C., thereby causing further crosslinking or chain extension of the polymer through the thermal sensitivity imparting groups.

The temperature selected for the second, thermal cure step generally depends on the thermal sensitivity imparting group which is present on the polymer. For example, ethynyl groups preferably are cured at temperatures of from 150 to about 300°C. Halomethyl groups preferably are cured at temperatures of from 150 to about 260°C. Hydroxymethyl groups preferably are cured at temperatures of from 150 to about 250°C. Phenylethynyl phenyl groups preferably are cured at temperatures of about 350°C. Vinyl groups preferably are cured at temperatures of from 150 to about 250°C. Allyl groups preferably are cured at temperatures of over about 260°C. Epoxy groups preferably are cured at temperatures of about 150°C. Maleimide groups preferably are cured at temperatures of from 300 to about 350°C. Benzocyclobutene groups preferably are cured at temperatures of over about 300°C. 5-Norbornene-2,3-dicarboximido groups preferably are cured at temperatures of from 250 to about 350°C. Vinyl ether groups preferably are cured at temperatures of about 150°C. Phenolic groups in the presence of hydroxymethyl or halomethyl groups preferably are cured at temperatures of from 150 to about 180°C. Alkylcarboxylate groups preferably are cured at temperatures of from 150 to about 250°C. Curing temperatures usually do not exceed 350 or 400°C., although higher temperatures can be employed provided that decomposition of the polymer does not occur. Higher temperature cures preferably take place in an oxygen-excluded environment.

Thus, applicants disclose the thermal crosslinking or chain extending to occur after crosslinking of photosensitive groups. Upon considering this point the examiner notes that either definition of claim 16 could be apt in view of the specification.

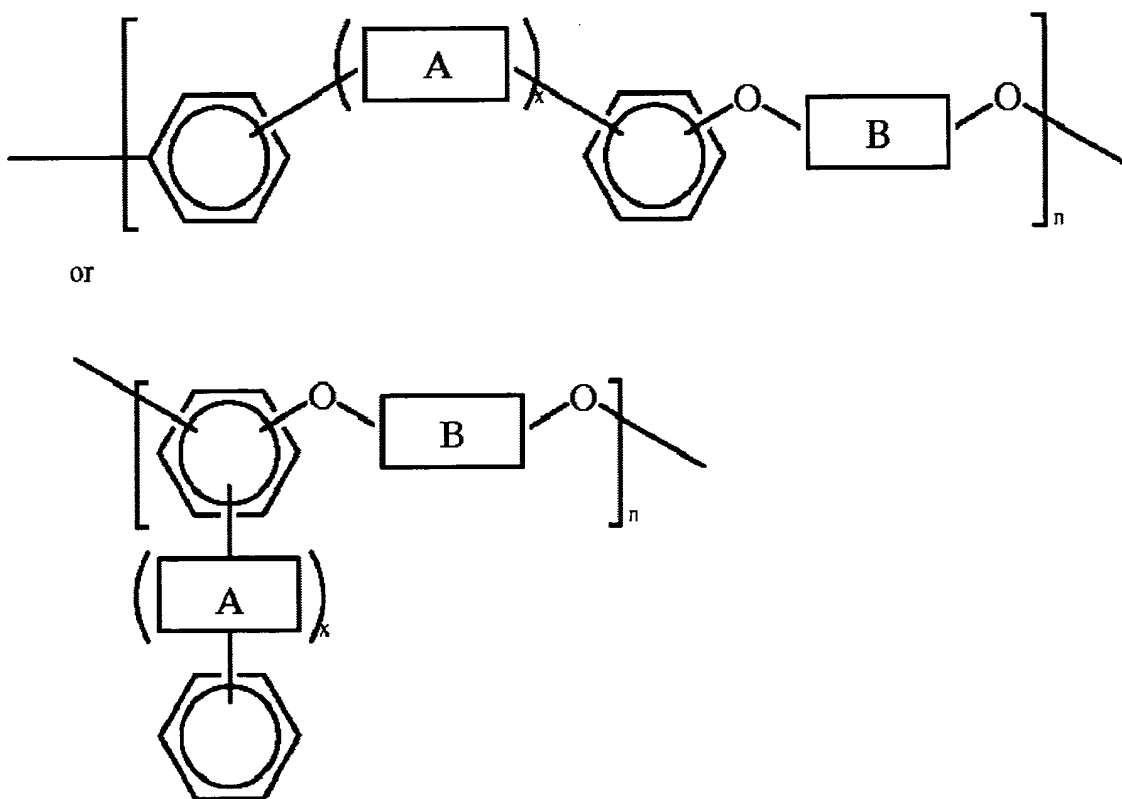
5. Claim 17 is withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 5. This leaves claims 16, 33, 44-45 and 57-60, 64-71 under examination in this application in view of a rejection outstanding over claim 16.

6. Claims 16, 33, 44-45 and 57-60, 64-71 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. First line after last chemical structure, "n is an integer representing the number of repeating monomer units". An integer by definition is according to The American Heritage Dictionary, Second College Edition "A member of the set of positive whole numbers ..., negative whole numbers, and zero..." Thus, without further definition by applicants a worker of ordinary skill in the art would recognize that negative numbers were not included. However, after defining n claim 16 states "said crosslinking or chain extension occurring through linking groups formed by a reaction between epoxy groups contained on at least some of the monomer repeat units of the precursor polymer.." it is not clear whether zero is a choice for n or not. Are the repeating monomer of the formula the repeating monomers necessary to have epoxy groups present to crosslink? Thus, is n=zero or n=1 part of the claimed invention in view of the need for repeat units? Thus, the limits of claims 16, 33, 44-

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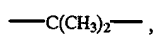
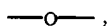
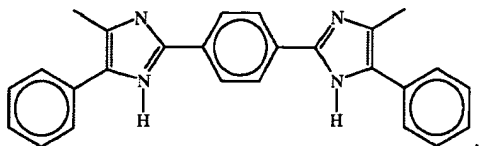
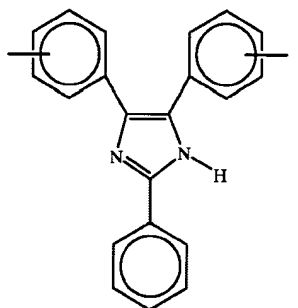
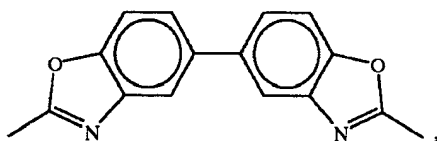
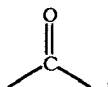
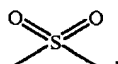
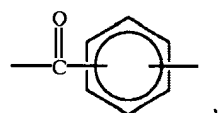
45 and 57-60, 64-71 are not clearly defined by this claim language in such a manner as to allow workers of ordinary skill in the art to determine the limits of the composition claimed.

7. Claims 16, 33, 44-45 and 57-60, 64-71 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The examiner is confused by the meaning of the formula in claim 16. The composition claimed is comprised of "a crosslinked or chain extended polymer of the formula



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The ends of the formula are open therefore undefined. At these endpoints any other repeating units could be present or chain extension could occur. However, with respect to A and B applicants define them as "A is

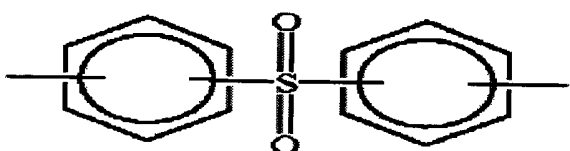
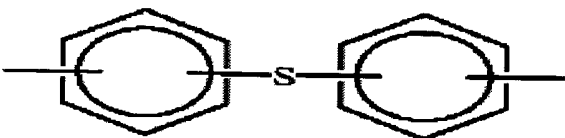
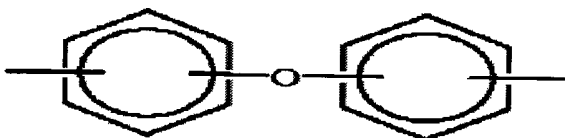
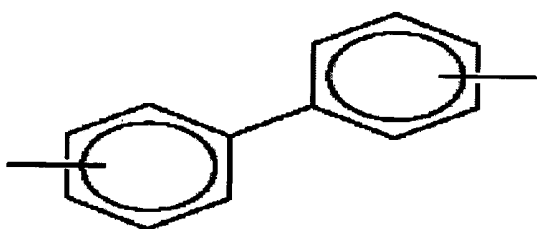
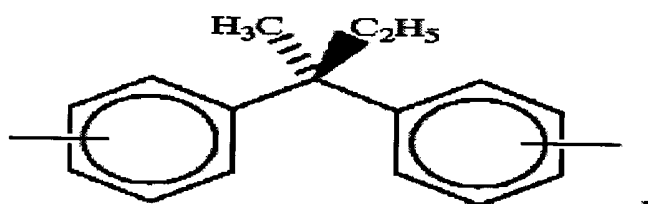
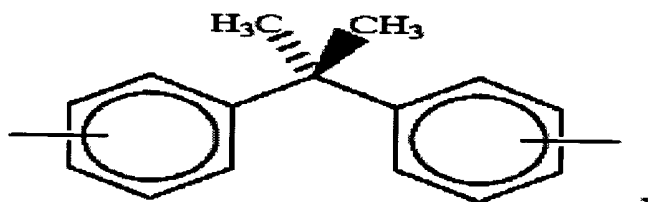
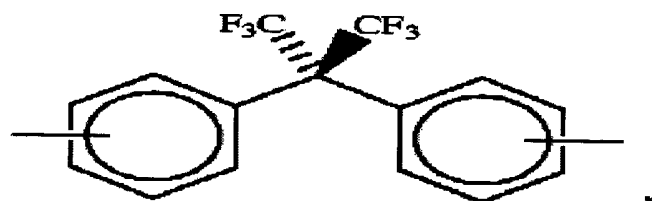


or mixtures thereof,

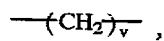
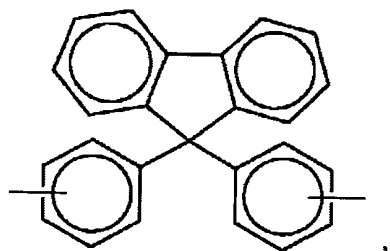
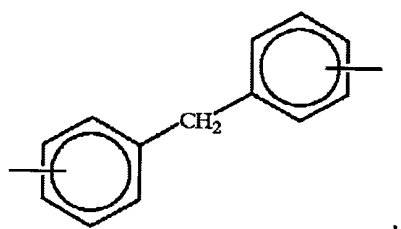
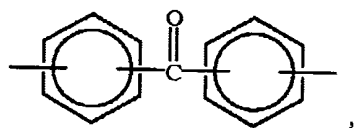


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and "B is

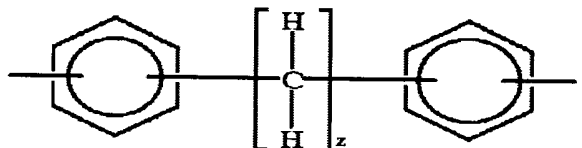


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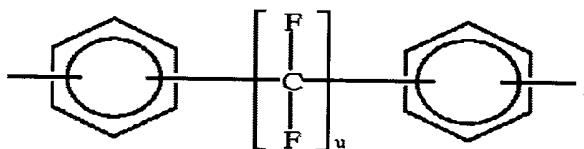


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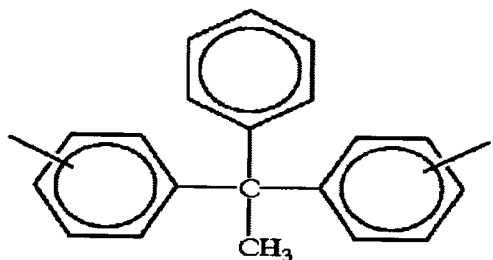
wherein  $v$  is an integer of from 1 to about 20,



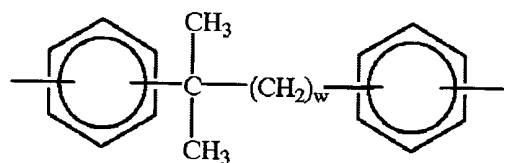
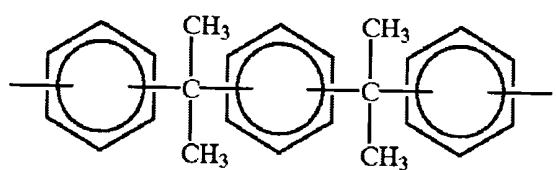
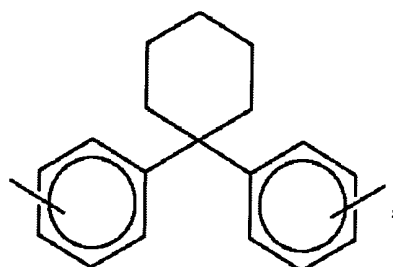
wherein  $z$  is an integer of from 2 to about 20,



wherein  $u$  is an integer of from 1 to about 20,

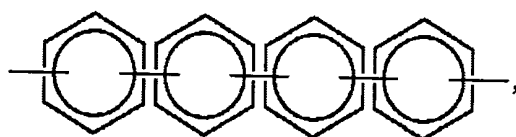
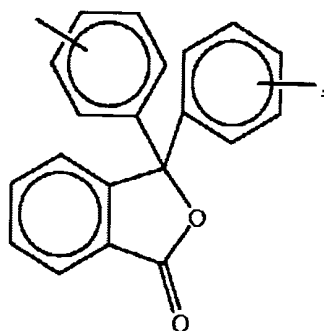
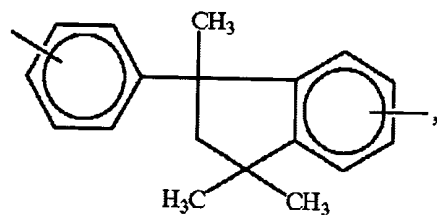


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wherein  $w$  is an integer of from 1 to about 20,

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or mixtures thereof," .

The use of "A is" and "B is" followed by a group of structures is considered in U.S. patent practice to exclude all other structures from A or B because this is defining a closed group for each of A and B. Applicants however at the end of the claim refer to "said crosslinking or chain extension occurring through linking groups formed by a reaction between epoxy groups contained on at least some of the monomer repeat units of the precursor polymer." Applicants in claim 16 do not define what is the precursor polymer. Thus, the only precursor polymer present

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must be the polymer of the formula given before crosslinking or chain extension. This polymer has no epoxy groups present. Nor does it have allyl ether groups claimed in instant claim 66. There is an issue as to what the "photosensitivity-imparting groups" of claims 64-66 are as well. Some of the groups of A and B above are known in the art to be photosensitive such as benzophenone structures but applicant's specification starting on page 52 after "DETAILED DESCRIPTION OF THE INVENTION", the original specification discloses "The curable polymers of the present invention are prepared from polymers of the following formula:" That formula is the same as in claim 16. However, after the formula, on page 58, starting at line 12, of the specification is found a further broadening of the formula, i.e. "The phenyl groups and the A and/or B groups may also be substituted, ...". This is not part of the claimed invention because this is not a definition of the formula in claim 16. If applicants want such substitution to be part of the claimed invention they need to insert it. Also found starting in line 15, same page, is "Substitutents can be present on the polymer either prior to or subsequent to the placement of photosensitivity-imparting functional groups thereon." A long list of substituents follows. Thus, the formula of claim 16 is the structure on starting on page 52 and not the substituted structure and/or structure with had the "photosensitivity-imparting functional groups" placed thereon. Since applicants reference epoxy groups and allyl ether groups clearly not part of the formula given in claim 16, there is some confusion as to whether the polymer of claim 16 is chain extended or crosslinked through groups not part of the formula given, i.e. groups beyond either end, or is part of the description of the "crosslinked or chain extended polymer of the formula" intended to cover the polymer made from said formula as described starting on page 52 such as substituents on A and/or B and the addition of "photosensitivity-imparting functional groups"?

It is not clear viewing the claimed invention and considering the original disclosure what the limits of claims 16, 33, 44-45 and 57-60, 64-71 really are. The formula given is not defined in the specification beyond the structure set forth. It is modified in various ways by applicants but not defined in such clear and unambiguous ways as to make clear what the limits are. Are there the further substitutions set forth or not? Thus, claims 16, 33, 44-45 and 57-60, 64-71 are held confusing in view of the claim language and specification.

8. Claims 64-66 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 64-66 are drawn to limitations with respect to the presence and amount of photosensitivity-imparting groups per monomer repeat unit and that they are either allyl ether or epoxy groups. Does the amount of "photosensitivity-imparting groups" reference all epoxy groups in a resin wherein some epoxy groups are used as "thermal sensitivity groups" or just that portion that is used as "photosensitivity-imparting groups"? If thermal crosslinking or extension is part of the polymer of claim 16 then to what does the degree of substitution in claims 64-66 refer? Is it after epoxy groups have been consumed? Is it after photo crosslinking or chain extending of the polymer because such thermal steps occur after this step as disclosed on pages 84-86? Is it in reference to the polymer prior to any crosslinking or chain extension as the limits of claims 57-60 are written when limiting weight average molecular weight? The only "precursor polymer" in the claim is the polymer of line 2 before crosslinking or chain extending. There is no "precursor polymer" defined in the specification. To be a "precursor" the polymer must preceed something. The only something to preceed is the "crosslinked or chain extended polymer. It cannot refer to polymers disclosed in the specification that do not have epoxy groups

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because the last three lines of claim 16 so state that the precursor polymer has the epoxy groups present. It states "epoxy groups contained on at least some of the monomer repeat units of the precursor polymer". Because there is no clear antecedent basis here, the term "the precursor polymer" is held indefinite. Is it before photocrosslinking, before thermal crosslinking, before both? The problem arises again in trying to interpret claim 66.



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**9. Broadest Reasonable Interpretation of the claims under examination**

**Claim 16.**

Units A in the formula of claim 16 are defined in amount by x. Thus, x can be zero, thus A is an optional component and not required present in the broadest reasonable interpretation of the polymer.

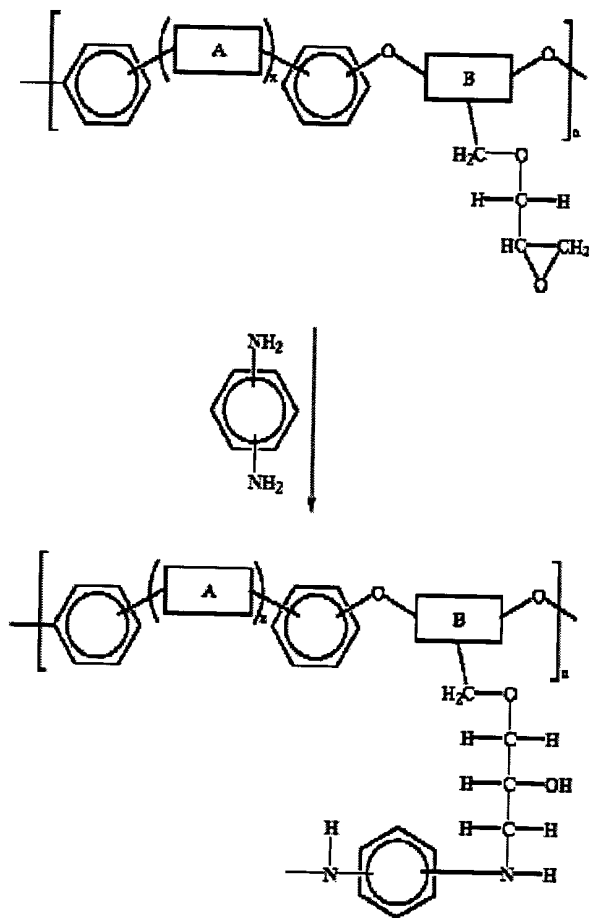
Due to confusion as to whether the amine curing agent is a component of the composition of claim 16 or is part of the process used to define the crosslinked or chain extended polymer, the examiner has considered both limitations in examining this claim.

In the last line of claim 16 is found "amine curing agent". No definition for "amine curing agent" is found in the original specification. The only use of this term is in the original claim 16 and those dependent upon it. The only reference found to "amine curing" is from page 100-101:

"Amine curing of the epoxidized polymer is also possible, with curing occurring upon the application of heat. While not being limited to any particular theory, it is believed that the curing scheme in one example is as

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follows:



On page 120 of the specification, lines 9-11 is found:

"If desired, a curing agent, such as the "Y" curative (meta-phenylenediamine) or the like, as well as mixtures thereof, can also be included in the photoresist solution."

This part of a description of one embodiment of applicant's invention in a paragraph spanning pages 119-121 in the specification. The context for the "Y" curative is as follows:

"In one embodiment, a heater wafer... is spin coated with a solution of Z6020 adhesion promoter .... The wafer is then allowed to cool at 25° C. for 5 minutes before spin coating the photoresist containing the photopatternable polymer onto the wafer... The photoresist solution is made by dissolving polyarylene ether ketone with from 1 to about 1.5 epoxy groups and from 0.1 to about 1.0 chloromethyl groups per repeat unit and a number average molecular weight of

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from 5,000 to about 7,000... in N-methylpyrrolidinone at 40 weight percent solids with Michler's ketone ... If desired, a curing agent, such as the "Y" curative (meta-phenylenediamine) or the like, as well as mixtures thereof, can also be included in the photoresist solution. The film is heated (soft baked) in an oven for between 10 and 15 minutes at 70° C. After cooling to 25° C. over 5 minutes, the film is covered with a mask and exposed to 365 nanometer ultraviolet light ... The exposed wafer is then heated at 70° C. for 2 minutes post exposure bake, followed by cooling to 25° C. over 5 minutes. The film is developed with any suitable developer... washed with 90:10 hexanes/cyclohexanone, and then dried at 70° C. for 2 minutes. A second developer/wash cycle is carried out if necessary to obtain a wafer with clean features. The processed wafer is transferred to an oven at 25 °C., and the oven temperature is raised from 25 to 90° C. at 2 °C. per minute. The temperature is maintained at 90° C. for 2 hours, and then increased to 260° C. at 2° C. per minute. The oven temperature is maintained at 260° C. for 2 hours and then the oven is turned off and the temperature is allowed to cool gradually to 25° C. When thermal cure of the photoresist films is carried out under inert atmosphere, such as nitrogen or one of the noble gases, such as argon, neon, krypton, xenon, or the like, there is markedly reduced oxidation of the developed film and improved thermal and hydrolytic stability of the resultant devices. Moreover, adhesion of developed photoresist film is improved to the underlying substrate. If a second layer is spin coated over the first layer, the heat cure of the first developed layer can be stopped between 80 and 260°. before the second layer is spin coated onto the first layer. A second thicker layer is deposited by repeating the above procedure a second time. This process is intended to be a guide in that procedures can be outside the specified conditions depending on film thickness and photoresist molecular weight... "

Meta-phenylenediamine and reference to the "Y" curative in this embodiment appear to reference the amine curing found on pages 100-101. The amine is added before imaging. However, it is unclear at what point the "Y" curative is activated. Reference is made to a "soft bake" before exposure to ultraviolet light, but the photoresist film is post baked before development and baked after development. "Thermal cure" is used with reference to using an inert atmosphere so as to markedly reduce oxidation of the "developed film". Then, there is " the heat cure of the first developed layer can be stopped between 80 and 260°. before the second layer is spin coated onto the first layer." Thus, thermal cure and heat cure in this paragraph on pages 119-121 seem to occur after imaging, thus crosslinking or chain extending with an amine

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curing agent in this embodiment appears to be the step after ultraviolet exposure. The examiner notes no mention of allyl ether groups is made in this embodiment. However, chloromethyl groups are present. The instant claims appear to exclude this photopatternable polymer if the chloromethyl groups are substituents found on A or B in the specification.

In another embodiment on pages 122 and 123 of applicant's disclosure, the following is found on page 122, lines 16-19:

"Curing agents such as the "Y" curative (meta-phenylenediamine) and the like, as well as mixtures thereof, can be used to cure the epoxy resin at typical relative amounts of about 10 weight percent curative per gram of epoxy resin solids."

This embodiment uses the photopatternable polymer admixed with an epoxy resin. This is to any of the photopatternable polymers in the invention. The separate epoxy resin is the material crosslinked with an amine to form better adhesive strength in the final printheads made from applicants' photopatternable polymers. This embodiment does not disclose epoxy groups on the photopatternable polymers. It does not exclude them either. The only example wherein epoxidation is used in the specification is Example III. There is no reference to any diamine or Y curative or meta-phenyldiamine. Thus, with respect to claim 16 and all claims dependent thereon, the meaning of amine curing agent could be any amine that can crosslink epoxy resins or crosslink via epoxy resins with thermal activation. The examiner cites as evidence what is considered an amine curing agent in the epoxy curing art. Kirk-Othmer in "Epoxy Resins" in "4.Curing Reactions" gives amines as coreactive curing agents that like applicant's example become part of the cured material. Such materials can cure at room temperature or at elevated temperatures depending on the choice made of amine. For crosslinking to occur the amine needs to possess at least two active hydrogen atoms as is evident from the overall reaction scheme set

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forth in Kirk-Othmer. Thus, the broadest reasonable interpretation of amine curing agent as found in claim 16 is an amine with at least two active hydrogens. The claim language does not exclude room temperature amine curing agents. However the "amine curing " of pages 100 and 101 of applicant's specification is "curing occurring upon the application of heat". Because of this, it is unclear whether applicants intend the "amine curing agent" of claim 16 to be limited to only those amines that cure under heating or are the broader range of amines included such as those that cure at room temperature. For this reason, the limits of claims 16, 33, 44-45 and 57-71 with respect to "amine curing agent" unclear. A rejection follows with respect to this point. For examination purposes, "amine curing agent" has been given it's broadest reasonable definition in view of the disclosure, i.e. any amine that can crosslink or chain extend an epoxy resin known in the art.

10. Claims 16, 33, 44-45 and 57-71 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. With respect to claim 16 and all claims dependent thereon, the meaning of amine curing agent could be any amine that can crosslink epoxy resins or crosslink via epoxy resins with thermal activation. The examiner cites as evidence what is consider an amine curing agent in the epoxy curing art. Kirk-Othmer in "Epoxy Reins" in "4.Curing Reactions" gives amines as coreactive curing agents that like applicant's example become part of the cured material. Such materials can cure at room temperature or at elevated temperatures depending on the choice made of amine. For crosslinking to occur the amine needs to possess at least two active hydrogen atoms as is evident from the overall reaction scheme set forth in Kirk-Othmer. Thus, the broadest reasonable interpretation of amine curing agent as

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found in claim 16 is an amine with at least two active hydrogens. The claim language does not exclude room temperature amine curing agents. However the "amine curing " of pages 100 and 101 of applicant's specification is "curing occurring upon the application of heat". Because of this, it is unclear whether applicants intend the "amine curing agent" of claim 16 to be limited to only those amines that cure under heating or are the broader range of amines included such as those that cure at room temperature, the limits of claims 16, 33, 44-45 and 57-71 are not clear. See the proceeding paragraphs to further explain this confusion.

**11. Broadest reasonable interpretation of the claim language of claim 33.**

A is defined in claim 33 but there is no requirement that A be present. The only limit claim 33 places on A is that if it is present then the structure is that given.

12. Claims 57-60 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicants have failed to state where support for the addition of limitations drawn to weight average molecular weight ranges can be found in the original specification and claims. Claims 57-60 refer to values that pertain to the polymer of claims 16 "prior to crosslinking or chain extension". Again a question as to what that polymer is occurs. Is it the polymer of the formula or is it the polymer with epoxy groups present or the polymer with allyl ether and epoxy groups present? The examiner found support for these ranges of weight average molecular weight on page 58 which is part of a paragraph that runs from page 52 to page 62. The molecular weights in this paragraph refer to the polymer of the formula and not the curable

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polymers of the present invention. This polymer of the formula is used to prepare the curable polymer of the "present invention" as disclosed on page 52 lines 21-23. The support in applicant's specification is as follows:

"The value of n is such that the weight average molecular weight of the material typically is from about 1,000 to about 100,000, preferably from about 1,000 to about 65,000, more preferably from about 1,000 to about 40,000, and even more preferably from about 3,000 to about 25,000, although the weight average molecular weight can be outside these ranges. Preferably, n is an integer of from about 2 to about 70, more preferably from about 5 to about 70, and even more preferably from about 8 to about 50, although the value of n can be outside these ranges."

Applicants have not cited support for this amendment with respect to the polymer with polymers with allyl ether groups and epoxy groups. Because it is not clear what polymer is the "polymer prior to crosslinking or chain extension", it is not clear whether support for the molecular weights set forth in claims 57-60 is present. The support given by this examiner is only for the polymer of the formula and not for the epoxidized polymer around before crosslinking and extension. Applicant has not pointed out where the amended claims 57-60 are supported, nor does there appear to be a written description of the claim limitations drawn to in claim 57 "wherein the value of n is such that the weight average molecular weight of the polymer prior to crosslinking or chain extension is from about 1000 to about 100,000", in claim 58, "wherein the value of n is such that the weight average molecular weight of the polymer prior to crosslinking or chain extension is from about 1000 to about 65,000, in claim 59, "wherein the value of n is such that the weight average molecular weight of the polymer prior to crosslinking or chain extension is from about 1000 to about 40,000, and in claim 60, "wherein the value of n is such that the weight average molecular weight of the polymer prior to crosslinking or chain extension is from about 3,000 to about 25,000" in the application as filed. See particularly MPEP 2163.04.

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13. Claim 64 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant has not pointed out where the amended claim is supported, nor does there appear to be a written description of the claim limitation "... wherein the polymer has a degree of substitution of an average from about 0.5 to about 2 photosensitivity-imparting groups per monomer repeat unit..." in the application as filed. See particularly MPEP 2163.04.

14. Claim 65 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant has not pointed out where the amended claim is supported, nor does there appear to be a written description of the claim limitation "... wherein the polymer has a degree of substitution of an average from about 0.5 to about 1.5 photosensitivity-imparting groups per monomer repeat unit..." in the application as filed. See particularly MPEP 2163.04.

15. Claim 66 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant has not pointed out where the amended claim is supported, nor does there appear to be a written description of the claim limitation "... wherein the polymer has a degree of substitution



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of from about 0.8 to about 1.8 milliequivalents of allyl ether or epoxy groups per gram of precursor polymer..." in the application as filed. See particularly MPEP 2163.04.

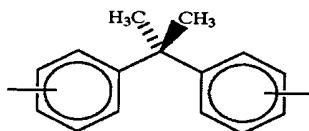
16. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

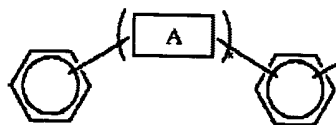
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

17. Claims 16, 45, 57-61, and 64-66 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsubaki et al (4,448,948). Example 8 of Tsubaki et al anticipates the composition of instant claims 16, 45, 57-61, 64-66 and 69 if the chain extended polymer of claim 16 is the product of (i) the product of the instant formula that has been further reacted at the ends to form epoxy groups and the end groups are instant B groups reacted with (ii) an amine curing agent. The cured varnish of Example 8 in Tsubaki et al is made from the epoxy resin of Example 1 cured with diaminodiphenyl sulfone as the hardener of Tsubaki et al disclosed in col. 1, lines 9-18 which is reads on the broadest reasonable definition of the instant amine curing agent set forth earlier in this action. Instant B in Example 1 of Tsubaki et al is derived from 2,2-bis(4-

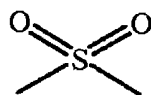
hydroxyphenyl)propane which gives B as



and instant



with x=1 and A being



derived from dichlorodiphenyl

sulfone. With respect to claim 45, the structure made in Example 1 and shown in col. 5, clearly have B as end groups of the polymer. The number average molecular weight of the resin of

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Tsubaki et al is about 2,200. The limit in claims 57 to 60 is expressed as weight average molecular weight. Number average molecular weights are either equal to weight average molecular weight or the weight average molecular weight is larger by definition. See Kaufman page 175 wherein monodisperse polymers have Number average molecular weights equal to weight average molecular weight, i.e. weight average molecular weight/ Number average molecular weights = 1.000. It is inherent in the definitions of these two weights that this is always so. The more variant the sizes of the polymer chains in the polymer resin the higher the larger weight average molecular weight will be. Thus, the number average molecular weight given in Tsubaki et al in Example 1 is always lower or equal to the weight average molecular weight of the instant claims. See Kaufmann on pages 162-164 and 175-176 for support of this well known relationship of these two kinds of molecular weight measurement. Thus, claims 57-60 are anticipated by Tsubaki et al as well. In Example 1, instant n is 4 and thus clearly the cured material anticipates the invention of instant claim 61. The degree of substitution of the epoxy groups in Example 1 of Tsubaki et al is 0.5. Epoxy groups are disclosed as photosensitivity groups in the instant specification. Thus, the compositions of claims 64-65 are anticipated by Tsubaki et al. Using 2 equivalents of epoxy groups/2,200 as molecular weight, then the resin of Tsubaki et al has 0.91 milliequivalents of epoxy groups /gram of precursor polymer if the precursor is the unchain extended polymer. Thus, with respect to instant claim 66, Tsubaki et al anticipates the instant composition with respect to epoxy groups before chain extension.

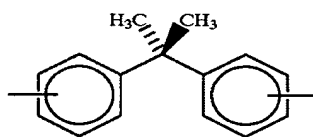
18. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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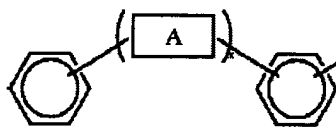
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

19. Claim 62 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubaki et al (4,448,948). Example 8 of Tsubaki et al anticipates the composition of instant claims 16, 45, 57-61, 64-66 and 69 if the chain extended polymer of claim 16 is the product of (i) the product of the instant formula that has been further reacted at the end repeat unit to form epoxy groups and the end groups are instant B groups reacted with (ii) an amine curing agent. The cured varnish of Example 8 in Tsubaki et al is made from the epoxy resin of Example 1 cured with diaminodiphenyl sulfone as the hardener of Tsubaki et al disclosed in col. 1, lines 9-18 which is reads on the broadest reasonable definition of the instant amine curing agent set forth earlier in this action. Instant B in Example 1 of Tsubaki et al is derived from 2,2-bis(4-

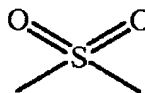
hydroxyphenyl)propane which gives B as



and instant



with  $x=1$  and A being



derived from dichlorodiphenyl

sulfone. . In Example 1, instant n is 4. In claim 62, the limit for n is "an integer from about 5 to about 70". The use of "about" here means the integer is not exactly from 5 to 70. Thus, the nearest about integer to 5 is 4. Therefore, the Example 8 of Tsubaki et al makes obvious the composition of claim 62 wherein 4 is held to be "about 5" because "an integer from about 5 to about 70" encompasses 4 if considered in its broadest reasonable sense. See particularly Ex

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parte Eastwood, 163 USPQ 316 (Bd. App. 1968) and W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983) "about" was held to allow flexibility around that defined.

20. Claims 16, 33, 45, and 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubaki et al (4,448,948). Example 5 of Tsubaki et al teach forming an epoxy resin like that of the abstract wherein 4,4'-dihydroxydiphenylmethane and 4,4'-difluorodiphenylketone are used to make the resin which is end capped with epoxy groups. This would make instant A as in claim 33 and B as in the third structure for B in instant claim 33 and in claim 69. This resin is not cured in the working examples of Tsubaki et al but the thrust of Tsubaki et al is set forth in col. 1, lines 9-17, wherein it is disclosed epoxy resins are hardened by amine among others. With respect to instant claims 16, 33, 45, and 69, the use of the epoxy resin with an amine hardener, i.e. the instant amine curing agent, to obtain a chain extended polymer would have been prima facie obvious in view of Tsubaki et al disclosing his objective in col. 1 to obtain an epoxy resin that would act better with respect to heat resistance, chemical resistance, water absorbability, mechanical properties and electrical properties than the curable resin cited in second paragraph that was cured optionally with amines.

21. The examiner notes with respect to applicants' Information Disclosure Statement filed January 7, 2002 incomplete copies of Eldin (4,667,010) which was missing col. 1-6 and Nelson et al (4,110,279) which was missing col. 3-12 were fully considered. A full copy of Eldin was found in the Parent Application No. 08/705,372 and all but one page of Nelson et al was found in the parent application. The examiner went ahead and retrieved full copies of both for review

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because all were considered in the parent application. An incomplete copy of EP 0663411 A1 was also sent. It was missing pages 6-9.

22. Claims 16, 44, 57-59, 61-62, and 64-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yokoshima et al (EP 0 663 411 A1). This rejection is made in view over substitution being or not being present in the formulas of claim 16. With respect to instant claims 16, 44, 57-59, 61-62, and 64-65, Yokoshima et al teach (a) which is a derivative of an epoxy resin that reads on the instant formula of claim 16 wherein A is  $-C(CH_3)_2-$  and B is  $(CH_2)_v$ , and B is substituted with  $-O(-M)_m(-H)_{n-m}$  as defined in the Abstract of Yokoshima et al wherein some of the epoxy groups have been substituted with unsaturated groups, i.e. the instant photosensitivity imparting groups and because epoxy is present as component (d) in Yokoshima et al, the optional epoxy resin-curing agent of page 8, lines 18-25, is present which includes polyamines such as diaminodiphenylmethane. The variance in the epoxy equivalency on page 4, lines 35-56 wherein n can be up to 10 on the average and epoxy equivalency can be up to 600 clearly shows that an epoxy of over 1000 molecular weight is part of the compositions of Yokoshima et al. Thus, the use of the epoxy acrylated resins of Yokoshima et al wherein some epoxy groups are left and crosslinked upon curing because a curing agent such as the polyamines cited are present makes prima facie obvious the instant compositions of claims 16, 44, 57-59, 61-62, and 64-65 to form photoimaging resist ink for solder masks with excellent adhesion and photosensitivity as well as heat resistance for use in forming flexible printed circuit boards.
23. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Chou (5,241,15) teach forming polyphenylene ethers with polar groups such as epoxies which are later reacted with diamines that react with the polar group modified

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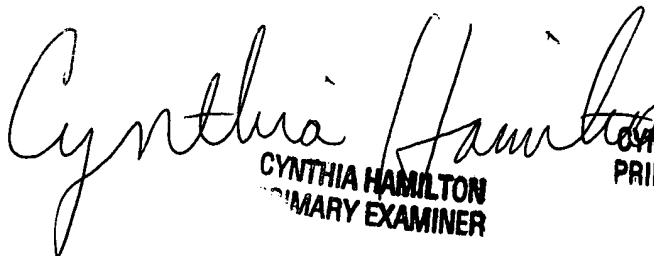
polyphenylether and an aromatic polycarbonate resin. In Chou, see particularly col. 2, lines 34-40 and col. 1, lines 29-68. Weber et al teach the same adaptation of polyphenylene ethers with epoxy groups in col. 1. Gawin et al (EP 0 252725 A2) in Table 1 teach mixing amine functional polyarylene polyether sulfone with diglycidyl compounds to form an epoxy crosslinked resin matrix.

*Any inquiry concerning this communication or earlier communications from the examiner should be directed to Primary Examiner Cynthia Hamilton whose telephone number is (703) 308-3626. The examiner can normally be reached on Monday-Friday, 9:30 am to 5:00 pm.*

*If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Janet Baxter can be reached on (703) 308-2303. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.*

*Any inquiry of a general nature or relating to the status of this application should be directed to the 1700 receptionist whose telephone number is (703) 308-0661.*

Cynthia Hamilton  
June 30, 2003

  
CYNTHIA HAMILTON  
PRIMARY EXAMINER

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